



## Chemical and physical properties

Microscope cover glasses made of borosilicate glass D 263® M

Chemical composition (approximative)								
SiO <sub>2</sub>	B <sub>2</sub> O <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>	Na <sub>2</sub> O	K <sub>2</sub> O	ZnO	TiO <sub>2</sub>	Sb <sub>2</sub> O <sub>3</sub>	Cl
64.0 %	8.5 %	4.0 %	6.5 %	7.0 %	5.5 %	4.0 %	< 0.5 %	< 0.1 %

Geometrical properties			
Thickness:	Nominal thickness in mm	Tolerance thickness in mm	Flatness in mm acc. to SEMI M1 GBINFER
Nr. 0	0.100	± 0.015	2.5
Nr. 1	0.145	± 0.015	2.5
Nr. 1 ½	0.175	± 0.015	2.5
Nr. 2	0.210	± 0.020	2.5

Quality properties	
Roughness (Ra)	≤ 1 nm

Optical properties		
Refractive indices	$n_g$	1.5354
	$n_{F'}$	1.5305
	$n_F$	1.5300
	$n_e$	1.5255 ± 0.0015
	$n_d$	1.5231
	$n_D$	1.5230
	$n_{C'}$	1.5209
	$n_C$	1.5204
Abbe value $v_e$		55
Photoelastic constant in (nm/cm)MPa		34.7



<b>Thermal properties</b>		
CTE (Coefficient of thermal expansion) $\alpha$	in $10^{-6}K^{-1}$ (20-300 °C)	7.2
Mean specific heat capacity $c_p$	in J/(gK) (20-100 °C)	0.8
Transformation temperature $T_g$	in °C	557
<u>Viscosities</u>	Viscosity $lg \eta$ in dPas	Temperature in °C
Strain point	14.5	529
Annealing point	13.0	557
Softening point	7.6	736

<b>Mechanical properties</b>		
Density $\rho$ (annealed at 40 °C/h)	in g/cm <sup>3</sup>	2.51
Chemical toughening ( $d = 0.145$ mm)	Temperature $\vartheta$ in °C Time $t$ in h Compressive stress (CS) in MPa Depth of layer (DoL) in $\mu$ m	390 4 290 15
Young's modulus $E$	in kN/mm <sup>2</sup>	72.9
Poisson's ratio $\mu$		0.21
Torsion modulus $G$	in kN/mm <sup>2</sup>	30
Knoop hardness	HK 0.1/20	470
Vickers hardness	HV 0.2/25	510

<b>Chemical properties</b>		
Hydrolytic resistance (acc. to DIN ISO 719)	Hydrolytic class Equivalent of alkali per gram glass grains in $\mu$ g/g	HGB 1 20
Acid resistance (acc. to DIN 12115)	Class Half surface weight loss after 6 hours in mg/dm <sup>2</sup>	S3 2.1
Alkali resistance (acc. to DIN ISO 695)	Class Surface weight loss after 3 hours in mg/dm <sup>2</sup>	A 2 88



Elektrical properties		
Dielectric constant $\epsilon_r$ (at $\vartheta = 25\text{ °C}$ )	at 1 MHz	6.7
	at 1 GHz	6.4
	at 5 GHz	6.3
Dissipation factor $\tan \delta$ (at $\vartheta = 25\text{ °C}$ )	at 1 MHz	$61 \cdot 10^{-4}$
	at 1 GHz	$74 \cdot 10^{-4}$
	at 5 GHz	$101 \cdot 10^{-4}$
Electric volume resistivity $\rho_D$ (for alternate current 50 Hz)	in $\Omega \cdot \text{cm}$	$1.6 \cdot 10^8$ ( $\vartheta = 250\text{ °C}$ )
	in $\Omega \cdot \text{cm}$	$3.5 \cdot 10^6$ ( $\vartheta = 350\text{ °C}$ )

Transmittance values		
Thickness 0.145 mm	Wavelength	$\tau(\lambda)$ in %
	at 254 nm	< 0.1
	at 380 nm	91.2
	at 632.8 nm	91.9
Edge wavelength $\lambda_c$ ( $\tau = 0.46$ )	at 1064 nm	92.2
	Thickness	Wavelength
	in mm	in nm
	0.100	308
	0.145	312
0.175	314	
0.210	315	
Luminous transmittance	Thickness in mm	$T_{VD65}$ in %
	0.145	$91.7 \pm 0.3$